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### RESEARCH ARTICLE

#### PREOPERATIVE CLOSE REDUCTION OF CERVICAL FRACTURE DISLOCATIONS

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##### Key words:-

Cervical Fracture Dislocation, Skull Traction, ASIA Scale

#### Abstract

**Study design:** Retrospective study.

**Purpose:** To determine Reduction rate of cervical fracture dislocations using preoperative gradual in hospital skull traction.

##### Overview of literature:

Cervical spine fracture dislocations are unstable injuries and require surgical intervention and stabilization. The approach may be anterior, posterior or combined. Majority of the surgeons prefer anterior approach after initial close reduction of cervical fracture dislocation. If close reduction preoperatively fails, then posterior direct reduction is needed followed by anterior surgery. In this study we intend to determine the rate of success (reduction) using preoperative gradual traction.

**Method:** This retrospective study was conducted at Spine Unit Hayatabad Medical Complex and Aman hospital Peshawar. All patients with cervical fracture dislocations presented between Jan 2015 & Jan 2019, who underwent cervical traction prior to surgical interventions were included in the study. The demographics, types of dislocation, preoperative traction, duration and neurology of all patients were recorded. The success of reduction using closed in hospital gradual traction was assessed using lateral cervical spine x-rays. Data was assessed using SPSS version 20.

**Results:** A total of 52 patients were included in the study with a mean age of 30.06 years ( $SD \pm 8.03$ ). In 35(67.3%) patients the dislocation was bifacetal while in 17(32.7%) it was unifacetal. Successful reduction using gradual in hospital awake traction was achieved in 39(75%) patients while in 13(25%) patients reduction was not achieved. Mean duration of preoperative traction was 3.6 ( $SD \pm 1.1$ ) days with minimum 2 days and maximum 7 days.

**Conclusion:** Gradual in hospital traction in awake patients is an effective mean of reducing cervical fracture dislocations.

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#### Introduction:-

Cervical spine injury is very common in blunt trauma mainly due to fall from height and road traffic accidents (RTA)<sup>1</sup>. About 2 to 6 % blunt trauma victims suffer from cervical spine injuries<sup>2</sup>. Reported incidence of cervical spine injuries in one large series is 64/100000 population. Cervical spine injuries in 55 % have associated spinal

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cord injury<sup>3</sup>. Traumatic spinal cord injury due to cervical fracture represents a major medical, psychological and socioeconomic problem<sup>4</sup>.

Cervical spine fracture dislocations are unstable injuries and require surgical intervention and stabilization. The approach may be anterior, posterior or combined<sup>5</sup>. Majority of the surgeons prefer anterior approach after initial close reduction of cervical fracture dislocation<sup>6</sup>. Along with other factors the decision about approach mainly depends on whether the dislocation is reduced or not and the presence of traumatic disc herniation. If the reduction is achieved with manipulation or traction preoperatively then the safe approach will be to do only anterior fusion. If the reduction is not possible closely then open reduction from the posterior should be done. If there is no traumatic disc herniation then posterior anterior approach is applied. If there is traumatic disc herniation then anterior posterior anterior approach is done<sup>7</sup>.

One of the most crucial steps in the management of cervical fracture dislocation is early reduction, realignment to prevent secondary spinal cord injury<sup>8</sup>. In our local setup in majority of the cases it is usually not possible to operate the patient on the same day. In this scenario skull traction provides an excellent method for preoperative reduction while patient is waiting for operative list. Early application of traction means success in reduction and better prognosis in term of neurological recovery<sup>9</sup>.

In our part of the world, cost of surgery plays a vital role. Two approaches mean double the cost for the patients. So if we can achieve preoperatively close reduction we can avoid second surgery by doing only anterior fusion. This approach is successfully reported even in the developed world but with rapid sequence traction manipulation in the operation theater<sup>10</sup>. Majority of these manipulations are done under general anesthesia or general sedation, which sometimes may exacerbate neurological injury<sup>10</sup>. While in gradual in hospital traction, patient is awake and is closely observed for worsening neurology.

In the current study we intend to provide our results with this middle path approach of using preoperative in hospital traction for reduction of sub axial cervical spine fracture dislocations. This regime evolved due to our local circumstances, but provides good results in term of reduction.

### **Materials And Methods:-**

This retrospective study was conducted at Spine Unit Hayatabad Medical Complex and Aman hospital Peshawar from Jan 2015 to June 2019. All patients with cervical fracture dislocations who underwent skull traction prior to surgical intervention were included in this study. All these patients gave written consent that their data can be used for research work.

All patients were initially stabilized according to ATLS protocol. Plain x-rays of the cervical spine were obtained in all cases. CT scan, MRI or 3D CT scan was obtained in selected cases. Initial stabilization of the spine was achieved with hard cervical collar. After stabilization of the patient, detailed history was obtained and complete examination was done. Patients' preoperative neurological status was graded according to ASIA scale.

Then patients were taken to the Operation Theater and axial Skull traction applied. Initially 10 to 15 kg weight was applied and then it was gradually increased by 2.5 kg increments every 6 to 8 hours till reduction was achieved. Maximum weight was calculated on the basis of 5kg for skull and 2.5 kg for each level. We do not delay traction for MRI to assess disc rather we gradually apply traction and closely monitor neurology for any deterioration. Serial x-rays were obtained in traction and neurology was monitored carefully. If dislocation reduced, patients were operated on next list using anterior approach. For unsuccessful reduction, posterior or combine approach was used.

Traction was discontinued if there were any signs of worsening of neurology or no improvement in dislocation after 2 days of applying maximum weight.

For fusion we use tricortical bone graft in ACDF or cage filled with autologous bone. We routinely use postoperative drain and Intravenous antibiotics for 5 days. Intravenous analgesia was given for initial 2 days.

The demographics, type of dislocation, preoperative traction duration and neurology of all patients were recorded. The success of reduction using closed in hospital gradual traction was also noted. Data was assessed using SPSS 20.

**Results:-**

Total of 52 patients were included in the study. Out of 52, majority 39(75%) were male patients and 13(25%) were female. Mean age of the group was 30.06 years (SD± 8.03) with minimum 18 years while maximum was 60 years. The main cause of trauma was road traffic accident. Out of 52 patients, 30 (57.7%) had RTA, while 18(34.6%) patients had history of fall and 4(7.7%) patients had diving injuries (Table: 1). The most common level of injury was C5-6 (44.2%) followed by C4-5 (30.8%)(Table: 2). In 35(67.3%) patients the dislocation was bifacetal while in 17(32.7%) it was unifacetal (Table: 3). Successful reduction using gradual in hospital awake traction was achieved in 39(75%) patients while in 13(25%) patients reduction was not achieved (Table: 4). Mean duration of preoperative traction was 3.6 (SD±1.1) days with minimum 2 days and maximum 7 days. This is duration of preoperative traction and does not show the duration in which reduction was achieved as retrospectively we can only assess the duration of preoperative traction.

Preoperative neurological injury was documented according to ASIA scale and was as follows: ASIA A=13 (25%), ASIA B=4 (7.7%), ASIA C=8 (15.4%), ASIA D= 9 (17.3%), and ASIA E=18 (34.6%)(Table: 5). After cross tabulation of preoperative neurology and type of dislocation it was clear that 11(84.6%) out of 13 patients with ASIA A had bifacetal dislocations. While 7(41.2%) out of 17 patients of unifacet dislocation had intact neurology (figure 1). We noticed improvement of neurology preoperatively with traction in 8(23.5%) patients out of 34 with neurological injury (Table: 6).

In 5(9.6%) patients we had complications, out of which in three patients readjustment was done due to loosening of tongs, one patient developed occipital decubitus ulcer while one patient died due to respiratory problems (Table: 7).

**Discussion:-**

Cervical fracture dislocations are unstable injuries and surgical intervention is indicated. Historically these were treated in halo traction conservatively but in the last three decades almost all cervical fracture dislocations are treated surgically<sup>11</sup>. Although surgical approach is dependent on many factors but we prefer anterior approach after closed reduction of cervical fracture dislocations to avoid two surgeries<sup>12</sup>. In the literature recommended approach is combine anterior and posterior stabilization but only anterior approach after close reduction in our experience has yielded good results<sup>13</sup>. There is increasing evidence of anterior reduction of cervical fracture dislocations but we do posterior reduction in cases of unsuccessful close reductions<sup>14</sup>.

We do not routinely obtain cervical spine MRI in cases of cervical fracture dislocations. We know that this is controversial and pre-traction MRI is desirable to exclude anterior ruptured disc in the canal<sup>15</sup>. We are of the opinion that traction should not be delayed in these cases, as realignment is the best form of decompression and prevention of secondary spinal cord injury<sup>16</sup>. Even in our local setup majority of patients present to us with MRI being done now a days. These days MRI is quite easy to perform. We will definitely do MRI if traction fails or there is worsening of neurology on traction.

There is still controversy regarding early decompression of spinal cord but has definitive advantage in partial spinal cord injury. In our local setup where immediate surgical intervention is usually not possible, cervical traction represents a form of early decompression. Reinhold et al reported clear advantage of early application of cervical traction in terms of both neurological recovery and dislocation reduction<sup>17</sup>. While there is very little hope for neurological recovery in patients with ASIA A neurology.

In quadriplegic patients there is very little hope of neurological recovery in our opinion. They should be operated as soon as possible because they very quickly develop respiratory complications and long preoperative traction is not desirable<sup>18, 19, 20</sup>.

One of the earliest studies on using close reduction with skull traction is done by Cotler and his colleagues<sup>21</sup>. They reported successful reduction of cervical fracture dislocation using manipulation and traction in 71% of their patients. This is similar to our results. They used close reduction with manipulation. With time we learned that it requires some time to achieve reduction and one has to be patient and closely observe the patient. Some times it requires a time break and then increase the weight. With this, as much as 25 kg can be applied. Star AM et al reported 39 out of 53 patients in whom reduction was achieved using more than 50 pounds<sup>22</sup>. They also reported

improvement of neurology in 68% of patients. In our series we documented improvement in neurology in 8(23.5%) out of 34 patients with neurological injury.

N Maru in his study on cervical spine injury in 25 patients used cervical traction as a definitive treatment and reduction in sub axial fractures<sup>23</sup>. He reported that majority of the patients can be treated conservatively and that skull traction is an effective tool for reduction and definitive treatment. He reported 20% complication rate with conservative treatment, mainly bedsores and respiratory problems. He also reported total of 5 (20%) deaths. 4 of them had sub axial spine injury with fracture dislocations and ASIA A neurology. This is in contrast to our study as we had one death in 52 (1.9%) patients with C3-4 dislocation having ASIA A neurology. The patient developed respiratory problem on the next day and died in ICU. This is quite low compared to N Maru's study but he used traction as a definitive method of treatment.

Modi JV in their case series of cervical spondyloptosis reported good results in terms of reduction with gradual traction<sup>24</sup>. They reported a total of 11 cases of Spondyloptosis and majority were at the junction of C7-T1. These are severe forms of fracture dislocations and thought to be very difficult to closed reduction. They reported successful reduction in 4 patients out of 8 in whom close reduction was used. We, in our series, had two patients with spondyloptosis, both with ASIA E neurology and we were able to achieve reduction in both patients (Figure 2 and 3).

Jiang X et al in their study of 52 cervical fracture dislocations reported effective close reduction preoperatively in 22 (42.3%) patients<sup>25</sup>. Their rate of reduction is quite low, 42 % against ours 75%. It may be due to the difference in method and not enough time was allowed for the reduction. Out of these 22 patients 17 were with traumatic disc herniation and were effectively reduced without any worsening of neurology. They routinely performed MRI preoperatively but there was no worsening of neurology with traction manipulation even with traumatic disc herniations and majority of these patients in whom reduction was achieved were having traumatic disc herniations. This again supports our view to avoid delay in reduction for the sake of MRI, which could be more than 24 hours in our setup. Although our focus is on preoperative reduction only but they reported good results with only anterior fusion in whom reduction was successful.

In 5(9.6%) patients we had complications. In three patients readjustment was done due to loosening, one patient developed occipital decubitus ulcer while one patient died due to respiratory problems. This is quite low compared to other studies like N MARU who reported 20% complications rate mainly cranial and gluteal sores however, he used traction as definitive treatment.

In a recent survey done by Workman MI et al on the closed reduction of cervical fracture dislocations, showed that majority of orthopedic and neurosurgeons were taught the method in residency. Majority agrees that this is the best and effective method of early reduction and decompression of spinal cord. It does not require MRI prior to traction and does not worsen the neurology<sup>26</sup>.

**Table 1:- Cause Of Trauma.**

	Frequency	Percent	Valid Percent	Cumulative Percent
RTA	30	57.7	57.7	57.7
FALL	18	34.6	34.6	92.3
DIVIN G	4	7.7	7.7	100.0
Total	52	100.0	100.0	

**Table 2:- Level Of Injury.**

	Frequency	Percent	Valid Percent	Cumulative Percent
C3-4	2	3.8	3.8	3.8
C4-5	16	30.8	30.8	34.6
C5-6	25	48.1	48.1	82.7
C6-7	9	17.3	17.3	100.0
Total	52	100.0	100.0	

**Table 3:-** Type Of Dislocation.

	Frequency	Percent	Valid Percent	Cumulative Percent
Unifacet	17	32.7	32.7	32.7
Bifacet	35	67.3	67.3	100.0
Total	52	100.0	100.0	

**Table 4:-** Preop Reduction.

	Frequency	Percent	Valid Percent	Cumulative Percent
SUCCESSFUL	39	75.0	75.0	75.0
UNSUCCESSFUL	13	25.0	25.0	100.0
Total	52	100.0	100.0	

**Table 5:-** Preop Neurology,

	Frequency	Percent	Valid Percent	Cumulative Percent
A	13	25.0	25.0	25.0
B	4	7.7	7.7	32.7
C	8	15.4	15.4	48.1
D	9	17.3	17.3	65.4
E	18	34.6	34.6	100.0
Total	52	100.0	100.0	

**Table 6:-** Neurology Improvement On Traction.

	Frequency	Percent	Valid Percent	Cumulative Percent
NO	26	50.0	76.5	76.5
YES	8	15.4	23.5	100.0
Total	34	65.4	100.0	
Missing	3	18	34.6	
Total	52	100.0		

**Table 7:-** Complications Of Traction.

	Frequency	Percent	Valid Percent	Cumulative Percent
NO COMPLICATION	47	90.4	90.4	90.4
READJUSTMENT	3	5.8	5.8	96.2
DECUBITUS ULCER	1	1.9	1.9	98.1
DEATH	1	1.9	1.9	100.0
Total	52	100.0	100.0	

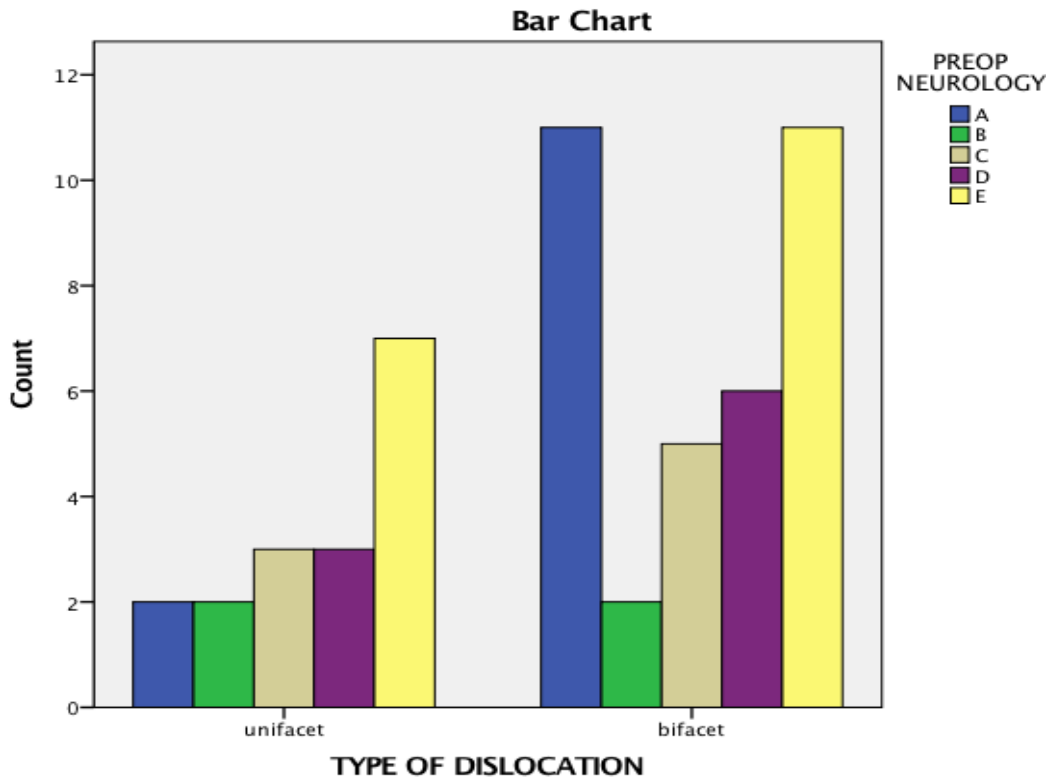


Figure 1:- Dislocation type versus preoperative neurology.



Figure 2:- Preoperative 3D CT scan.



**Figure 3:-** Postoperative X-ray.

### **Conclusion:-**

Preoperative in hospital skull traction can be effectively used for stabilization and reduction of cervical fracture dislocations. This is easy and can be rapidly done in limited resources areas without MRI. It realigns spine and prevents secondary spinal cord injury providing best hope for recovery in partial neurological injury. In complete neurological injury with quadriplegia, traction should be applied for stabilization & reduction but they should be operated as soon as possible without waiting for close reduction.

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